

REMARKS

Introduction

In response to the Office Action dated February 26, 2007, Applicants have amended claims 1 and 5. Claim 4 has been cancelled. Support for amended claim 1 is found in, for example, originally filed claim 4. Care has been taken to avoid the introduction of new matter. Claims 10-26 are withdrawn. In view of the foregoing amendments and the following remarks, Applicants respectfully submit that all pending claims are in condition for allowance.

Claim Rejection Under 35 U.S.C. § 102

Claim 1 stands rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,248,481 (hereinafter Visco). Amended claim 1 recites, "...said non-aqueous electrolyte includes a quaternary ammonium salt." In the present application, the use of a quaternary ammonium salt as an electrolyte in the battery having an elemental sulfur positive electrode and a silicon negative electrode facilitates the reaction of silicon and sulfur with lithium (as described in page 6, line 22 to page 7, line 2), which results in an enhancement of the charging-discharging characteristics.

Inventive example 1 in the present application, for example, uses a non-aqueous electrolyte including a lithium salt, $\text{LiN}(\text{CF}_3\text{SO}_2)_2$, dissolved at a concentration of 0.3 mol/l in a room temperature molten salt of trimethylpropylammonium bis(trifluoromethylsulfonyl)imide (pg. 36, lines 1-8). Trimethylpropylammonium bis(trifluoromethylsulfonyl)imide in inventive example 1 is "a quaternary ammonium salt." By contrast in comparative Example 3, a non-aqueous electrolyte including a lithium salt, $\text{LiN}(\text{CF}_3\text{SO}_2)_2$ dissolved at a concentration of 0.5 mol/l in 1,3-dioxolane was used (pg. 60, lines 16-21). In Comparative Example 4, a non-

aqueous electrolyte including a lithium salt, $\text{LiN}(\text{CF}_3\text{SO}_2)_2$ dissolved at a concentration of 0.5 mol/l in tetrahydrofuran was used (pg. 70, line 21 – pg. 71, line 1). In Comparative Example 5, a non-aqueous electrolyte including a lithium salt, $\text{LiN}(\text{CF}_3\text{SO}_2)_2$ dissolved at a concentration of 0.5 mol/l in 1,2-dimethoxyethane was used (pg. 81, lines 1-6). In the inventive example 1, for example, the average discharge voltage was approximately 2 V (*see, e.g.*, pg. 40, lines 6-11). In comparison, the average discharge voltage was approximately 1.2 V for comparative examples 3, 4, and 5 (*see, e.g.*, pg. 62, lines 1-7; pg. 72, lines 7-12; and pg. 82, lines 16-19). Thus, the invention described in example 1 increases the specific discharge capacity compared to alternatives.

Turning to the Office Action, Visco describes a non-aqueous electrolyte secondary battery having a positive electrode, a negative electrode, and a non-aqueous electrolyte, where the positive electrode includes elemental sulfur and the negative electrode includes silicon that stores lithium (col. 4, lines 28-40). However, the Office Action does not discuss the alleged teachings of Visco with respect to dependent claim 4, which is now incorporated into claim 1.

Visco discusses electrolytes in which polysulfides, for example, are rather soluble including *amides* such as acetamide, dimethylacetamide, and 1-methyl-2-pyrrolidinone (col. 4, lines 1-4). An amide is an amine where the nitrogen has three substituent groups and one of the nitrogen substituents is an acyl group. In contrast, the quaternary ammonium salt required in claim 1 is a quaternary ammonium salt in which all of the hydrogens and the lone electron pair have been replaced by an alkyl group, for example, NR_4 .

Thus, Visco fails to disclose, at a minimum, "...said non-aqueous electrolyte includes a quaternary ammonium salt," as required by amended claim 1.

As anticipation under 35 U.S.C. § 102 requires that each and every element of the claim be disclosed, either expressly or inherently (noting that “inherency may not be established by probabilities or possibilities,” *Scaltech Inc. v. Retec/Tetra*, 178 F.3d 1378 (Fed. Cir. 1999)), in a single prior art reference, *Akzo N.V. v. U.S. Int’l Trade Commission*, 808 F.2d 1471 (Fed. Cir. 1986), based on the forgoing, it is submitted that Visco does not anticipate claim 1.

Claim Rejection Under 35 U.S.C. § 103

Claims 1, 8, and 9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Visco in view of EP 1231651 (hereinafter Ikeda). Claims 8 and 9 depend from claim 1 and include all of the features of that claim plus additional features, which are not taught or suggested by the cited references. Therefore, for at least these reasons, it is respectfully submitted that claims 8 and 9 also patentably distinguish over the cited references.

Claim Rejection Under 35 U.S.C. § 102/103

Claims 1-7 stand rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Visco. Visco does not anticipate or suggest the claimed non-aqueous electrolyte secondary battery.

The Office Action states, “however, if the claims are not anticipated, in the alternative, they are obvious because Visco teaches an acetamide electrolyte, which would inherently have a melting point of not higher than 60° C.”

Visco discusses using electrolytes including amides, such as acetamide, dimethylacetamide, and 1-methyl-2-pyrrolidinone (col. 4, lines 1-4). The amides discussed in Visco are amines where the nitrogen has three substituent groups and one of the nitrogen

substituents is an acyl group. In contrast, a quaternary ammonium salt required in the present application is an ammonium salt in which all the hydrogens have been replaced by an alkyl group, for example, NR₄. Thus, Visco fails to disclose, at a minimum, "...said non-aqueous electrolyte includes a quaternary ammonium salt," as recited in amended claim 1.

Applicants further submit that Visco does not suggest the claimed non-aqueous electrolyte secondary battery or the melting point of the non-aqueous electrolyte.

The Office Action alleged that the claimed melting point is inherently met by the electrolyte disclosed in the applied reference. Applicants submit that the Examiner's reliance on inherency is in error. The Examiner has not discharged the initial burden of establishing a *prima facie* basis to deny patentability, and that the Examiner's reliance upon the doctrine of inherency is misplaced. The Examiner has merely asserted that the claimed melting point is inherent because the cited reference teaches an acetamide electrolyte. However, Applicants submit that simply because a certain thing may result from a given set of circumstances is not legally sufficient to establish inherency. *In re Rijckaert*, 9 F.3d 1531, 28 USPQ2d 1955 (Fed. Cir. 1993); *In re Oelrich*, 666 F.2d 578, 212 USPQ 323, (CCPA 1981). The Examiner has not set forth the requisite extrinsic evidence to make clear that the missing melting point must necessarily be present in the cited reference, and that the claimed melting point would be so recognized by persons of ordinary skill. Accordingly, the Examiner did not discharge that burden of indicating where the claimed non-aqueous electrolyte includes a quaternary ammonium salt or where the melting point of the non-aqueous electrolyte appears in Visco. Accordingly, the rejections should be withdrawn for at least these reasons.

Conclusion

In view of the above amendments and remarks, Applicants submit that this application should be allowed and the case passed to issue. If there are any questions regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated to expedite the prosecution of the application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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